CLAIMS

1. A magnetic read head comprising:

a spin valve sensor that includes:

nonmagnetic conductive first and second spacer layers;

a ferromagnetic free layer structure located between the first and second spacer layers and having a magnetic moment;

an antiferromagnetic pinning layer;

a pinned layer structure located between the first spacer layer and the pinning layer and having a magnetic moment pinned by the pinning layer;

a nonmagnetic conductive specular reflector layer structure; and

a self-pinned layer located between the second spacer layer and the specular reflector layer structure and having a magnetic moment that can be pinned by sense current fields parallel to the magnetic moment of the pinned layer structure.

2. A magnetic read head as claimed in claim 1 wherein the read head further includes:

nonmagnetic nonconductive first and second read gap layers;

the spin valve sensor being located between the first and second read gap layers;

ferromagnetic first and second shield layers; and

the first and second read gap layers being located between the first and second shield layers.

3. A magnetic read head as claimed in claim 2 including:

the specular reflector layer structure having first and second specular reflector layers;

the first specular reflector layer being composed of copper (Cu) and the second specular reflector layer being composed of silver (Ag); and

the first specular reflector layer being located between and interfacing the second specular reflector layer and the self-pinned layer.

4. A magnetic read head as claimed in claim 2 including:

the specular reflector layer structure having first and second specular reflector layers;

the first specular reflector layer being composed of copper (Cu) and the second specular reflector layer being composed of gold (Au); and

the first specular reflector layer being located between the second specular reflector layer and the self-pinned layer.

5. A magnetic read head as claimed in claim 2 wherein the free layer structure is located between the first gap layer and the pinning layer.

6. A magnetic read head as claimed in claim 5 wherein the pinned layer structure is an antiparallel (AP) pinned layer structure comprising:

ferromagnetic first and second antiparallel (AP) pinned layers; and

an antiparallel (AP) coupling layer located between the first and second AP pinned layers.

7. A magnetic read head as claimed in claim 5 wherein the pinned layer structure is a ferromagnetic single pinned layer.

8. A magnetic read head as claimed in claim 7 including:

the specular reflector layer structure having first and second specular reflector layers;

the first specular reflector layer being composed of copper (Cu) and the second specular reflector layer being composed of silver (Ag); and

the first specular reflector layer being located between and interfacing the second specular reflector layer and the self-pinned layer.

9. A magnetic read head as claimed in claim 8 wherein the self-pinned layer has a thickness that is less than the single pinned layer.

10. A magnetic read head as claimed in claim 2 wherein the free layer structure is located between the second gap layer and the pinning layer.

11. A magnetic read head as claimed in claim 10 wherein the pinned layer structure is an antiparallel (AP) pinned layer structure comprising:

ferromagnetic first and second antiparallel (AP) pinned layers; and

an antiparallel (AP) coupling layer located between the first and second AP pinned layers.

12. A magnetic read head as claimed in claim 10 wherein the pinned layer structure is a ferromagnetic single pinned layer.

13. A magnetic read head as claimed in claim 12 including:

the specular reflector layer structure having first and second specular reflector layers;

the first specular reflector layer being composed of copper (Cu) and the second specular reflector layer being composed of silver (Ag); and

the first specular reflector layer being located between and interfacing the second specular reflector layer and the self-pinned layer.

14. A magnetic read head as claimed in claim 13 wherein the self-pinned layer has a thickness that is less than the single pinned layer.

15. A magnetic head assembly having a read head and a write head comprising:

the write head including:

first and second pole piece layers;

each of the first and second pole piece layers having a yoke portion located between a pole tip portion and a back gap portion;

a nonmagnetic write gap layer located between the pole tip portions of the first and second pole piece layers;

an insulation stack with at least one coil layer embedded therein located between the yoke portions of the first and second pole piece layers; and

the first and second pole piece layers being connected at their back gaps portions; and

the read head including:

a spin valve sensor located between nonmagnetic nonconductive first and second read gap layers; and

the first and second read gap layers being located between a ferromagnetic first shield layer and the first pole piece layer; and

the spin valve sensor including:

nonmagnetic conductive first and second spacer layers;

a ferromagnetic free layer structure located between the first and second spacer layers and having a magnetic moment;

an antiferromagnetic pinning layer;

a pinned layer structure located between the first spacer layer and the pinning layer and having a magnetic moment pinned by the pinning layer,

a nonmagnetic conductive specular reflector layer structure; and

a self-pinned layer located between the second spacer layer and the specular reflector layer structure and having a magnetic moment that can be pinned by sense current fields parallel to the magnetic moment of the pinned layer structure.

16. A magnetic head assembly as claimed in claim 15 including:

the read head further including:

a ferromagnetic second shield layer;

a nonmagnetic electrically insulative separation layer; and

the separation layer being located between the second shield layer the first pole piece layer.

17. A magnetic head assembly as claimed in claim 15 including:

the specular reflector layer structure having first and second specular reflector layers;

the first specular reflector layer being composed of copper (Cu) and the second specular reflector layer being composed of silver (Ag); and

the first specular reflector layer being located between and interfacing the second specular reflector layer and the self-pinned layer.

18. A magnetic head assembly as claimed in claim 15 including:

the specular reflector layer structure having first and second specular reflector layers;

the first specular reflector layer being composed of copper (Cu) and the second specular reflector layer being composed of gold (Au); and

the first specular reflector layer being located between the second specular reflector layer and the self-pinned layer.

19. A magnetic head assembly as claimed in claim 15 wherein the free layer structure is located between the first gap layer and the pinning layer.

20. A magnetic head assembly as claimed in claim 19 wherein the pinned layer structure is an antiparallel (AP) pinned layer structure comprising:

ferromagnetic first and second antiparallel (AP) pinned layers; and

an antiparallel (AP) coupling layer located between the first and second AP pinned layers.

21. A magnetic head assembly as claimed in claim 19 wherein the pinned layer structure is a ferromagnetic single pinned layer.

22. A magnetic head assembly as claimed in claim 21 including:

the specular reflector layer structure having first and second specular reflector layers;

the first specular reflector layer being composed of copper (Cu) and the second specular reflector layer being composed of silver (Ag); and

the first specular reflector layer being located between and interfacing the second specular reflector layer and the self-pinned layer.

23. A magnetic head assembly as claimed in claim 22 wherein the self-pinned layer has a thickness that is less than the single pinned layer.

24. A magnetic disk drive having at least one slider that has an air bearing surface (ABS), the slider supporting at least one magnetic head assembly that includes a read head and a write head, the disk drive comprising:

the write head including:

first and second pole piece layers;

each of the first and second pole piece layers having a yoke portion located between a pole tip portion and a back gap portion;

a nonmagnetic write gap layer located between the pole tip portions of the first and second pole piece layers;

an insulation stack with at least one coil layer embedded therein located between the yoke portions of the first and second pole piece layers; and

the first and second pole piece layers being connected at their back gaps portions; and

the read head including:

a spin valve sensor located between nonmagnetic nonconductive first and second read gap layers; and

the first and second read gap layers being located between a ferromagnetic first shield layer and the first pole piece layer; and

the spin valve sensor that including:

nonmagnetic conductive first and second spacer layers;

a ferromagnetic free layer structure located between the first and second spacer layers and having a magnetic moment;

an antiferromagnetic pinning layer;

a pinned layer structure located between the first spacer layer and the pinning layer and having a magnetic moment pinned by the pinning layer;

a nonmagnetic conductive specular reflector layer structure; and

a self-pinned layer located between the second spacer layer and the specular reflector layer structure and having a magnetic moment that can be pinned by sense current fields parallel to the magnetic moment of the pinned layer structure;

a housing;

a magnetic disk rotatably supported in the housing;

a support mounted in the housing for supporting the magnetic head assembly with its ABS facing the magnetic disk so that the magnetic head assembly is in a transducing relationship with the magnetic disk;

a spindle motor for rotating the magnetic disk;

an actuator connected to the support for moving the magnetic head assembly to multiple positions with respect to said magnetic disk; and

a processor connected to the magnetic head assembly, to the means for rotating the magnetic disk and to the actuator for exchanging signals with the magnetic head assembly, for controlling movement of the magnetic disk and for controlling the position of the magnetic head assembly.

25. A magnetic disk drive as claimed in claim 24 including:

the read head further including:

a ferromagnetic second shield layer;

a nonmagnetic electrically insulative separation layer; and

the separation layer being located between the second shield layer the first pole piece layer.

26. A magnetic disk drive as claimed in claim 24 including:

the specular reflector layer structure having first and second specular reflector layers;

the first specular reflector layer being composed of copper (Cu) and the second specular reflector layer being composed of silver (Ag); and

the first specular reflector layer being located between and interfacing the second specular reflector layer and the self-pinned layer.

27. A magnetic disk drive as claimed in claim 24 including:

the specular reflector layer structure having first and second specular reflector layers;

the first specular reflector layer being composed of copper (Cu) and the second specular reflector layer being composed of gold (Au); and

the first specular reflector layer being located between the second specular reflector layer and the self-pinned layer.

28. A magnetic disk drive as claimed in claim 24 wherein the free layer structure is located between the first gap layer and the pinning layer.

29. A magnetic disk drive as claimed in claim 28 wherein the pinned layer structure is an antiparallel (AP) pinned layer structure comprising:

ferromagnetic first and second antiparallel (AP) pinned layers; and

an antiparallel (AP) coupling layer located between the first and second AP pinned layers.

30. A magnetic disk drive as claimed in claim 28 wherein the self-pinned layer structure is a ferromagnetic single pinned layer.

31. A magnetic disk drive as claimed in claim 30 including:

the specular reflector layer structure having first and second specular reflector layers;

the first specular reflector layer being composed of copper (Cu) and the second specular reflector layer being composed of silver (Ag); and

the first specular reflector layer being located between and interfacing the second specular reflector layer and the self-pinned layer.

32. A magnetic disk drive as claimed in claim 31 wherein the self-pinned layer has a thickness that is less than the single pinned layer.

33. A method of making a magnetic read head comprising the unordered steps of:

making a spin valve sensor as follows:

forming nonmagnetic conductive first and second spacer layers;

forming a ferromagnetic free layer structure between the first and second spacer layers that has a magnetic moment;

forming an antiferromagnetic pinning layer;

forming a pinned layer structure between the first spacer layer and the pinning layer with a magnetic moment pinned by the pinning layer;

forming a nonmagnetic conductive specular reflector layer structure; and

forming a self-pinned layer between the second spacer layer and the specular reflector layer structure having a magnetic moment that can be pinned by sense current fields parallel to the magnetic moment of the pinned layer structure.

34. A method as claimed in claim 33 wherein the making of the read head further includes the unordered steps of:

forming nonmagnetic nonconductive first and second read gap layers;

forming the spin valve sensor between the first and second read gap layers;

forming ferromagnetic first and second shield layers; and

forming the first and second read gap layers between the first and second shield layers.

35. A method as claimed in claim 34 including:.

forming the specular reflector layer structure with a first specular reflector layer composed of copper (Cu) and a second specular layer composed of silver (Ag); and

forming the first specular reflector layer between and interfacing the second specular reflector layer and the self-pinned layer.

36. A method as claimed in claim 34 including:

forming the specular reflector layer structure with a first specular reflector layer composed of copper (Cu) and a second specular reflector layer composed of gold (Au); and

forming the first specular reflector layer between the second specular reflector layer and the pinned layer.

37. A method as claimed in claim 34 wherein the free layer structure is formed between the first gap layer and the pinning layer.

38. A method as claimed in claim 37 wherein the pinned layer structure is formed of an antiparallel (AP) pinned layer structure, the method of making the AP pinned layer structure comprising the unordered steps of:

forming ferromagnetic first and second antiparallel (AP) pinned layers; and

forming an antiparallel (AP) coupling layer between the first and second AP pinned layers.

39. A method as claimed in claim 37 wherein the pinned layer structure is formed of a ferromagnetic single pinned layer.

40. A method as claimed in claim 39 including:

forming the specular reflector layer structure with a first specular reflector layer composed of copper (Cu) and a second specular layer composed of silver (Ag); and

forming the first specular reflector layer between and interfacing the second specular reflector layer and the self-pinned layer.

41. A method as claimed in claim 40 wherein the self-pinned layer is formed with a thickness that is less than a thickness of the single pinned layer.

42. A method of making a magnetic head assembly that includes a write head and a read head comprising the unordered steps of:

making the write head as follows:

forming first and second pole piece layers with each of the first and second pole piece layers having a yoke portion located between a pole tip portion and a back gap portion;

forming a nonmagnetic write gap layer between the pole tip portions of the first and second pole piece layers;

forming an insulation stack with at least one coil layer embedded therein between the yoke portions of the first and second pole piece layers; and

connecting the first and second pole piece layers at their back gaps portions; and

making the read head as follows:

forming a spin valve sensor between nonmagnetic nonconductive first and second read gap layers; and

forming the first and second read gap layers between a ferromagnetic first shield layer and the first pole piece layer; and

making the spin valve sensor as follows:

forming nonmagnetic conductive first and second spacer layers;

forming a ferromagnetic free layer structure between the first and second spacer layers that has a magnetic moment;

forming an antiferromagnetic pinning layer;

forming a pinned layer structure between the first spacer layer and the pinning layer with a magnetic moment pinned by the pinning layer;

forming a nonmagnetic conductive specular reflector layer structure; and

forming a self-pinned layer between the second spacer layer and the specular reflector layer structure having a magnetic moment that can be pinned by sense current fields parallel to the magnetic moment of the pinned layer structure.

43. A method as claimed in claim 42 wherein the making of the read head further includes:

forming a ferromagnetic second shield layer; and

forming a nonmagnetic nonconductive separation layer between the second shield layer and the first pole piece layer.

44. A method as claimed in claim 42 including:

forming the specular reflector layer structure with a first specular reflector layer composed of copper (Cu) and a second specular layer composed of silver (Ag); and

forming the first specular reflector layer between and interfacing the second specular reflector layer and the self-pinned layer.

45. A method as claimed in claim 42 including:

forming the specular reflector layer structure with a first specular reflector layer composed of copper (Cu) and a second specular reflector layer composed of gold (Au); and

forming the first specular reflector layer between the second specular reflector layer and the self-pinned layer.

46. A method as claimed in claim 42 wherein the free layer structure is formed between the first gap layer and the pinning layer.

47. A method as claimed in claim 46 wherein the pinned layer structure is formed of an antiparallel (AP) pinned layer structure, the method of making the AP pinned layer structure comprising the unordered steps of:

forming ferromagnetic first and second antiparallel (AP) pinned layers; and

forming an antiparallel (AP) coupling layer between the first and second AP pinned layers.

48. A method as claimed in claim 46 wherein the pinned layer structure is formed of a ferromagnetic single pinned layer.

49. A method as claimed in claim 48 including:

forming the specular reflector layer structure with a first specular reflector layer composed of copper (Cu) and a second specular layer composed of silver (Ag); and

forming the first specular reflector layer between and interfacing the second specular reflector layer and the self-pinned layer.

50. A method as claimed in claim 49 wherein the self-pinned layer is formed with a thickness that is less than a thickness of the single self-pinned layer.